Final Report

Inventory of Terrestrial Vertebrates at

John Muir National Historic Site

and

Eugene O'Neill National Historic Site

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Summary

We initiated inventories in non-developed areas of both John Muir and Eugene O'Neill National Historic Sites in January 2001 with searches for reptiles and amphibians under natural debris. In February and March 2001, we began a more formal inventory that included: 1) automatic cameras for photographing large and medium-sized mammals, 2) periodic live trapping for small mammals, and 3) use of artificial cover boards to attract and find reptiles and amphibians. Field work was completed in April 2003. The surveys detected the following numbers of species:

- John Muir NHS: 16 mammals, 5 reptiles, and 5 amphibians;
- Eugene O'Neill NHS: 9 mammals, 5 reptiles, and 1 amphibian.

Background

John Muir National Historic Site is located in Martinez, California. The site preserves the 14-room mansion where the naturalist John Muir lived from 1890 until his death in 1914. The site also includes Mount Wanda to the south, a 325-acre tract of oak woodland and grassland that was historically owned by the Muir family.

Eugene O'Neill National Historic Site is a 13-acre site located in the hills above Danville, California. It includes the Tao House, where Eugene O'Neill lived from 1937 to 1944, as well as the adjacent courtyard, orchards, and small amounts of grassland and oak woodland.

Prior to our work, neither site had been surveyed for amphibians, reptiles, or mammals. The purpose of our study was to conduct an initial inventory of these vertebrates at the two National Historic Sites.

Methods

Automatic cameras. We used automatic cameras to document the occurrence of large- and medium-sized mammals (Wemmer et al., 1996). The camera was a modified Olympus Mini DLX, triggered by a Trailmaster 1500 unit (Goodson & Associates, Lenexa, KS 66215). The Trailmaster includes a transmitter and receiver. The transmitter produces a beam of infrared light that is not visible

to humans or wildlife. The Trailmaster is situated so that the infrared beam crosses a wildlife trail at a height of about 8". When the beam is broken by a passing animal (or vegetation) for at least 3/20th of a second, the camera is triggered, and a single picture is taken. We configured the Trailmaster so that the camera cannot be triggered again until at least one minute has passed, thus reducing the number of photographs of a single animal that lingers in the area. We chose sites for cameras by selecting the wildlife trail that appeared to have the most activity. The camera was set to take pictures 24 hours per day. The location of cameras at John Muir and Eugene O'Neill National Historic Sites are shown in Figures 1 and 2. At both parks, camera locations were chosen away from the areas most frequented by park visitors; even so, one Trailmaster setup was stolen at John Muir NHS.

Live trapping. At John Muir NHS, ventilated Sherman live mammal traps (3" wide x 3 ½" high x 9" long Sherman traps, H.B. Sherman, Gainesville, Florida) were baited with grain and placed at 5 - 10 meter intervals (Wemmer et al., 1996). The traps were checked on each of the following three or four days, and the trapped animals were identified and released. Each survey used sets of 20 traps that were arranged in a roughly linear transect. The transects were separated by at least 250 meters.

At Eugene O'Neill NHS, two traps were placed near each of the 10 artificial cover boards, which were located around the perimeter of the study area (Fig. 2).

Artificial cover boards. Cover boards consisted of two pieces of ½" thick x 2' x 4' external grade plywood (Fellers and Drost, 1994). Cover boards were set out in pairs so the effective area was 4' x 4'. Vegetation under the boards was cleared away so that the boards sat directly on the ground. Twenty-five pairs of boards were installed at John Muir NHS and 10 pairs at Eugene O'Neill NHS (Fig. 1 and 2). Boards were checked by lifting each board and capturing any animals underneath. Animals were released under the board after being identified and, in some cases, photographed.

Searches under natural cover. These searches consisted of looking under large rocks and downed wood (Aubry et al., 1988; Campbell and Christman, 1982; Corn and Bury 1990, 1991). This type of search was used primarily at John Muir NHS since there was sufficient natural cover to make this an effective technique. During the course of the inventory, all parts of Mount Wanda were searched. Much more limited natural cover searches were conducted at Eugene O'Neill NHS. These searches covered the undeveloped part of the site as outlined in Figure 2.

Results

The Trailmaster cameras recorded 12 species of medium- and large-sized mammals at John Muir NHS (Table 1), and 10 species at Eugene O'Neill NHS (Table 2). We photographed the same five species of native mammals at each

site (coyote, gray fox, mule deer, raccoon, and striped skunk). There were two introduced species at John Muir NHS (Eastern fox squirrel, opossum), and the same two species as well as a red fox at Eugene O'Neill NHS. There were a variety of domestic mammals, with the greatest diversity at John Muir NHS. This diversity probably reflects the presence of a small ranch immediately to the east of John Muir NHS, as all the animals photographed were apparently local.

Although not shown in Tables 1 and 2, birds were also photographed by the cameras. The most interesting of these were screech owl, great horned owl, and introduced wild turkey, all at John Muir NHS. People were also photographed at John Muir NHS.

Tables 3 and 4 show the results of the live trapping and surveys for animals under artificial cover boards and natural cover at the two parks. Together, these techniques detected five species of small mammals, five amphibians, and five reptiles at John Muir NHS and three small mammals, one amphibian, and five reptiles at Eugene O'Neill NHS.

Discussion

John Muir and Eugene O'Neill National Historic Sites would be expected to have similar sets of terrestrial vertebrates, as the two parks are only 12 miles apart and are both situated in the hills on the west side of the Diablo/San Ramon Valley, where the habitat is a mix of oak woodland and grassland, with some brush. Both parks are along the border between

residential areas and large open areas that include units of the East Bay Regional Park System. In comparing our survey results at John Muir NHS and Eugene O'Neill NHS, we would expect to find more species at John Muir because there was a larger natural area for searches, cameras, and trapping. Tables 1 – 4 show this to be somewhat true, but there were two species found only at Eugene O'Neill NHS, the red fox and ring-necked snake.

Large and medium-sized mammals. Mule deer, raccoons, striped skunks, and gray foxes were photographed as expected, since these native mammals are known to be both common and widespread in California (Jameson and Peeters, 1988). On the other hand, no photos were taken of bobcats, brush rabbits, black-tailed jackrabbits, or badgers, which are also are widespread and common. No inherent problem exists in photographing any of these species, as our extensive surveys at the Point Reyes National Seashore have produced many pictures of them all, with brush rabbit and bobcat photos being particularly numerous. Additional photography at either John Muir or Eugene O'Neill NHS, may eventually detect some or all of these species.

In both parks, the introduced fox squirrel was frequently photographed, while there were no photos of the native western gray squirrel. It is not clear if this is a case of displacement by the introduced species, as the both parks appear to be at the very edge of the range for the native squirrel (Jameson and Peeters, 1988).

Small mammals. Most of our small mammal trapping at both parks has been in oak woodland and brushy areas, so it is not surprising that we caught large numbers of brush mice, a partially arboreal species. The western harvest mice and California meadow voles were caught primarily in traps in the grasslands. Our failure to trap any deer mice is surprising, since that species is common and widespread throughout California, and has been by far the most common mammal found in our trapping at Point Reyes. Perhaps the deer mouse is in competition with the extremely common brush mouse at John Muir and Eugene O'Neill National Historic Sites.

Reptiles. The potential list of reptiles that might occur at either John Muir NHS or Eugene O'Neill NHS is fairly long. We have, however, only found five species in each of the parks. At John Muir, the additional species that seem most likely to occur include racer, gopher snake, ring-necked snake, and western rattlesnake. Species that are somewhat less likely to occur are western pond turtle (especially along Franklin Cr.), two-striped garter snake, and southern alligator lizard. Any of these reptiles might well be located during further surveys.

The list of undocumented species that might occur within Eugene O'Neill NHS is similar to that of John Muir NHS. Park staff have reported western rattlesnakes, an easily recognized species that would be expected in the area. Garter snakes and the western pond turtle would be more likely to occur at

Eugene O'Neill NHS (compared with John Muir NHS) due to the presence of a large pond immediately adjacent to the park.

Most of the reptiles that have not been documented in the two parks fall into one of two categories: 1) species for which there is marginally good habitat (e.g. garter snakes), or 2) species that occur at fairly low densities even within their preferred habitats. Hence, it is difficult to document their occurrence and/or map their distribution during a survey such as ours. Much more extensive surveys will be required to document the less common species.

Amphibians. At John Muir NHS, most of the expected amphibians were captured under natural debris or under the artificial cover boards. Three species that seem moderately likely to occur were not found (rough-skinned newt, western toad, bullfrog - an introduced species in the west), and two somewhat unlikely species were not found (red-legged frog, foothill yellow-legged frog). The absence of these species probably reflects the lack of suitable breeding habitat in or near the park.

At Eugene O'Neill NHS, we have only found California slender salamanders. While the amount of suitable habitat for amphibians is extremely limited, the large pond adjacent to the park may provide habitat for one or two amphibians that could occur within the park on occasion. The most likely species would be the Pacific treefrog and California newt. If bullfrogs and/or red-legged frogs occur in the adjacent pond, they would also be expected at Eugene O'Neill NHS, at least on occasional warm, rainy nights.

Ensatina and arboreal salamanders are moderately common in habitats such as those to the west of Eugene O'Neill NHS, and they might be found within the park on occasion. It is a bit surprising that neither of these species were recorded during our surveys.

Conclusion. The inventory surveys conducted between January 2001 and March 2003 were successful in detecting a good diversity of amphibians, reptiles, and mammals. Like most inventories, it is difficult to document the less common species, so there are certainly species that occasionally occur in both parks that are not included in the lists here (Tables 1 - 4). Continuing field work will likely fill in some of these gaps over time.

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Table 1. Large- and medium-sized mammals photographed with automatic cameras at John Muir National Historic Site, Martinez, CA.

Native Mammals - 5 species	
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
Mule Deer	*Odocoileus hemionus*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephitis mephitis*
Introduced Mammals - 2 species	
Eastern Fox Squirrel	*Sciurus niger*
Opossum	*Didelphis marsupialis*
Domestic Mammals - 6 species	
Dog	*Canis familiaris*
Domestic Cat	*Felis domesticus*
Goat	*Capra hircus*
Horse	*Equis caballus*
Pig	*Sus scrofa*

Table 2. Large- and medium-sized mammals photographed with automatic cameras at Eugene O'Neill National Historic Site, Danville, CA.

Native Mammals - 5 species	
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
Mule Deer	*Odocoileus hemionus*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephitis mephitis*
Introduced Mammals - 3 species	
Eastern Fox Squirrel	*Sciurus niger*
Opossum	*Didelphis marsupialis*
Red Fox	*Vulpes fulva*
Domestic Mammals - 2 species	
Dog	*Canis familiaris*
Domestic Cat	*Felis domesticus*

Table 3. Small mammals, amphibians, and reptiles recorded at John Muir National Historic Site, Martinez, CA.

MAMMALS	
Brush mouse	*Peromyscus boylei*
Western harvest mouse	*Reithrodontomys megalotus*
California meadow vole	*Microtus californicus*
House mouse	*Mus musculus*
Dusky-footed woodrat	*Neotoma fuscus*
REPTILES	
Sharp-tailed snake	*Contia tenuis*
Common kingsnake	*Lampropeltis getula*
Western fence lizard	*Sceloporus occidentalis*
Western skink	*Eumeces skiltonianus*
Northern alligator lizard	*Elgaria* (=*Gerrhonotus*) *coerulea*
AMPHIBIANS	
California slender salamander	*Batrachoseps attenuatus*
Ensatina	*Ensatina eschscholtzii*
Arboreal salamander	*Aneides lugubris*
California newt	*Taricha torosa*
Pacific tree frog	*Hyla* (=*Pseudacris*) *regilla*

Table 4. Small mammals, amphibians, and reptiles recorded at Eugene O'Neill National Historic Site, Danville, CA.

MAMMALS	
Brush mouse	*Peromyscus boylei*
Western harvest mouse	*Reithrodontomys megalotus*
California meadow vole	*Microtus californicus*
REPTILES	
Sharp-tailed snake	*Contia tenuis*
Ring-necked snake	*Diadophis punctatus*
Common kingsnake	*Lampropeltis getula*
Western fence lizard	*Sceloporus occidentalis*
Western skink	*Eumeces skiltonianus*
AMPHIBIANS	
California slender salamander	*Batrachoseps attenuatus*

Figure 1. Map of inventory sites at John Muir National Historic Site, Martinez, CA.

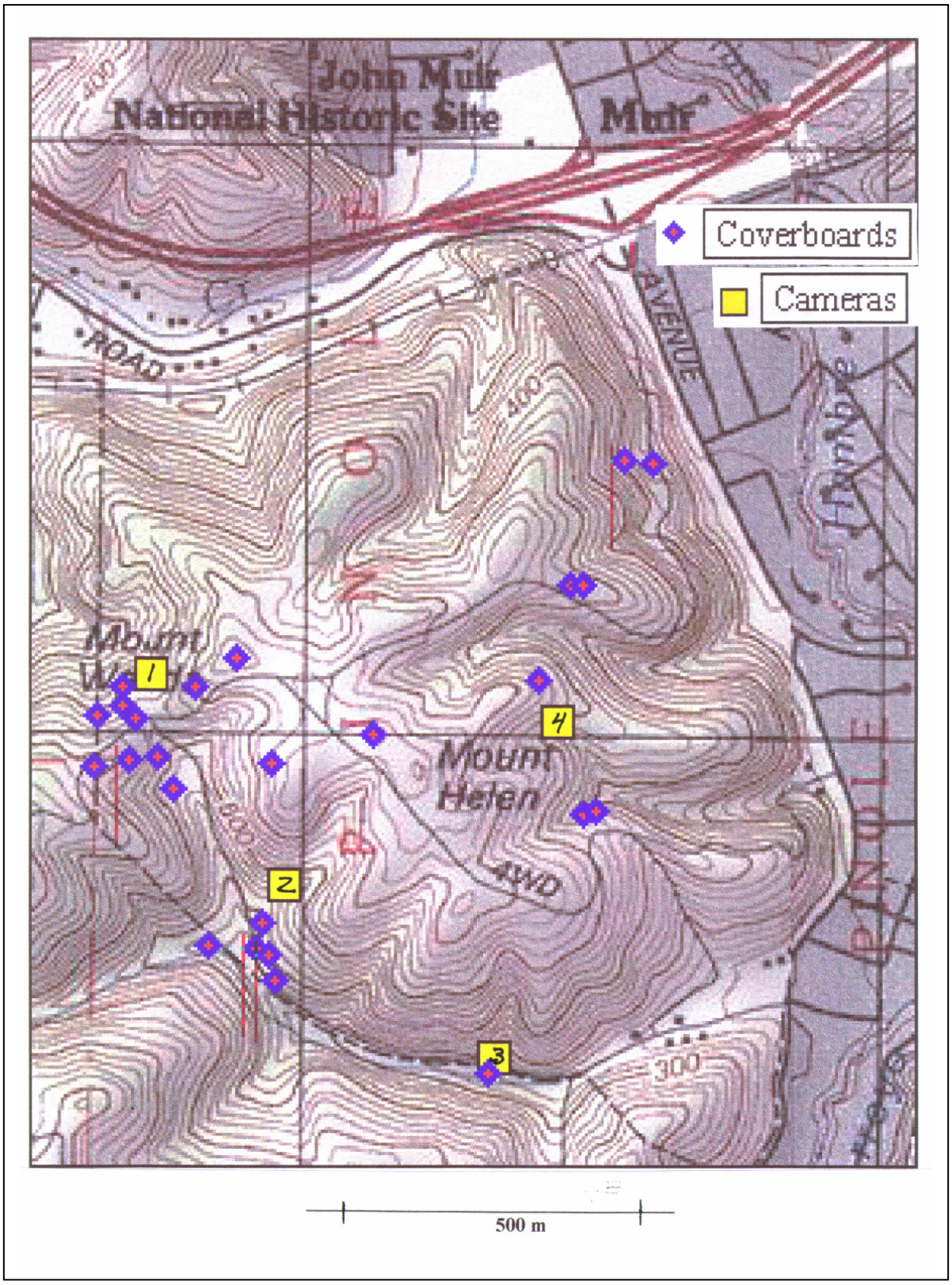

Figure 2. Map of inventory sites at Eugene O'Neill National Historic Site. Note that there is a second camera location (outside the main study area) near the pond.